

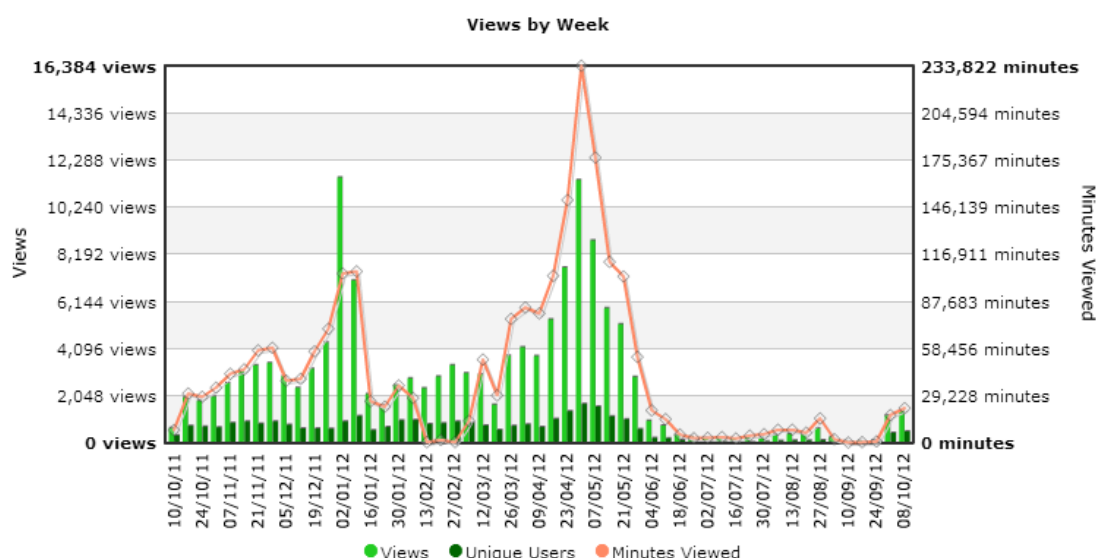
THE IMPACT OF ASTON REPLAY ON STUDENT PERFORMANCE

CHRIS JONES AND MATT OLCZAK

1. Introduction

Aston Replay is a tool that allows live lectures to be recorded and made available for students to view online. In the last few years, it has been increasingly widely used across the University. **Figure 1** shows the total amount of views (light green bars) and the total number of minutes viewed (orange line) across the entire University for the 2011-12 academic year.

Figure 1: Aston Replay Data for the whole of Aston



There is one striking fact that jumps straight out from this figure; the number of views and the total number of minutes viewed peaks substantially during the two examination periods. A closer inspection suggests that the amount of views and the number of minutes viewed trends upwards prior to each examination period and then drops off significantly once the examination period ends. This information leads to a number of interesting questions which the remainder of this paper will address:

- Does watching Aston Replay improve a student's module performance?
- Does watching Aston Replay impact differently across modes of assessment?
- Does watching Aston Replay only during the "revision period" impact upon student performance?

Each of these questions will be analysed using multiple regression analysis on data for the module BS1102 Economic Environment of Business taught to 1st year undergraduates in teaching period 2 by Dr Chris Jones. The remainder of this paper is set out as follows: in **Section 2** we briefly discuss the sample size, module assessment and descriptive statistics of the student cohort. In **Section 3** we present the empirical methodology and report the results. Finally, in **Section 4** we compare our findings with the related previous literature and make some suggestions for professional practice.

2. Data

Economic Environment of Business is worth 10 credits and comprises 20 lecture hours and 5 tutorial hours. Assessment is via a two hour examination comprising of a 40 question multiple choice test and two essays (one on microeconomics and one on macroeconomics). The majority of the 424 students on this course are not from single honours business programmes. They comprise students from Marketing, Human Resource Management, Combined Honours Business, International Business & Modern Languages, Law with Management and Computing for Business.

Descriptive statistics for this module are presented in **Table 1**. Overall, 47% of students are male and 15% of students are from overseas. The average age at entry is just over 19 years. The average mark for BS1102 is 53% (70% for the multiple choice component and 51% for the essays) compared to an average year mark across all modules of 55%. The overall satisfaction score was 4/5 for this module, as determined by the Aston Business School student evaluation form. It might be the case that the use of Aston Replay in this module has had an impact on this satisfaction score. Indeed, many positive comments commended the use of Aston Replay.

Table 1: Descriptive Statistics

Variable	Observations	Mean	Std. Dev.	Min	Max
Gender (1 if male)	424	0.47	0.50	0	1
Overseas Student (1 if overseas)	424	0.15	0.36	0	1
Age on entry (in years)	424	19.19	2.57	17	42
BS1102 Mark (%)	424	53.33	20.47	0	95
Essay Mark (%)	346	51.16	15.88	0	93.2
Multiple Choice Mark (%)	348	70.30	14.94	15	100
1st Year Mark (%)	411	55.41	14.76	0	82.3
Watched Aston Replay (1if watched)	424	0.55	0.50	0	1

Note: It has not been possible to obtain some marks for all of the students and therefore in these cases the number of observations is less than 424.

Every live lecture was recorded using Aston Replay. In total there were 11 lectures, one of which was a revision session delivered at the end of the final lecture. Each lecture lasted between 1-2 hours. In total 55% of students watched part of at least one recording of the lectures between the recording of the first lecture and the examination. **Table 2** provides additional statistic for these students. On average, out of the 235 students who watched Aston Replay, students watched approximately five of the lectures. In terms of hours, the average student who watched Aston Replay watched for approximately 7.5 hours. Nevertheless, only 69 students watched Aston Replay at all prior to what we define as the revision period¹ with 166 students watching Aston Replay only after this cut-off date.

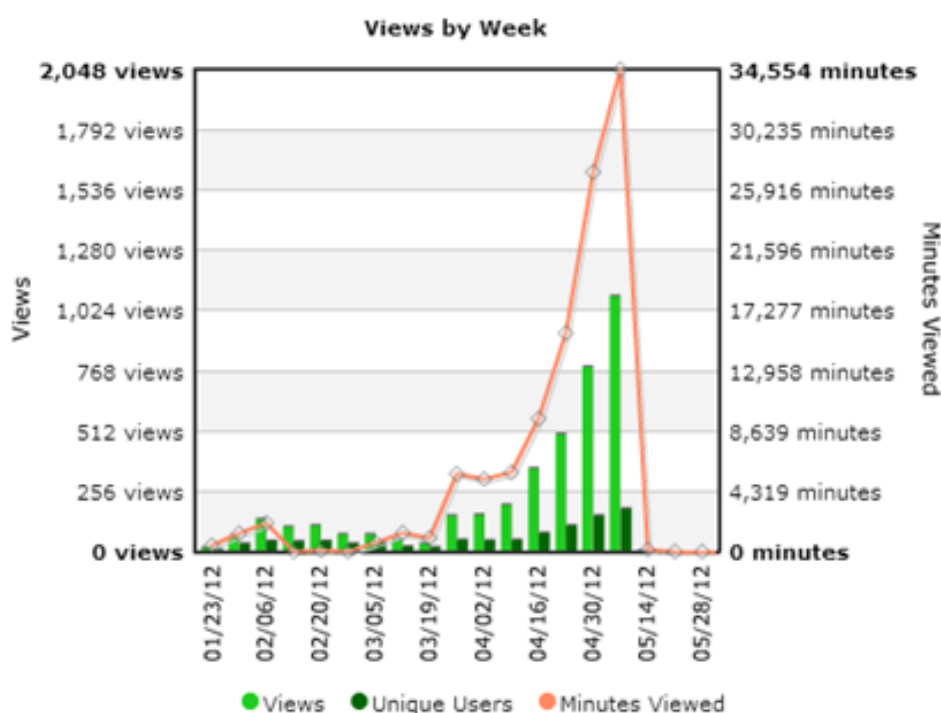
Table 2: Descriptive Statistics for Students who Watched Aston Replay

Variable	Observations	Mean	Std. Dev.	Min	Max
Number of lectures watched	235	5.28	3.45	1	11
Total amount of minutes watched	235	452.19	498.10	0.52	2668.27
Watched after the revision period only	235	0.71	0.45	0	1

Figure 2 below shows Aston Replay data for module BS1102. As can be seen, the viewing data appears similar to **Figure 1** above. The use of Aston Replay peaks substantially leading up to the examination period (23/05/12).

¹ We define the revision period as beginning on the 23rd March 2012 (the last day of term prior to Easter).

Figure 2: Aston Replay Data for BS1102



3. Empirical Methodology and Results

We ran a number of Ordinary Least Squares (OLS) regressions in order to address the questions outlined above in the introduction. OLS allows the researcher to consider the impact of a unit change in an explanatory variable on the dependent variable of interest. In our model, the dependent variable we are interested in is student performance (measured by % module score). Most of the control variables included are called dummy variables, for instance the variable “Watched Aston Replay” equals 1 if a student has watched Aston Replay at any point in time over the duration of the course, it equals 0 otherwise. In this case, each coefficient estimate tells us the average impact (%) switching the variable from 0 to 1 has on a student’s module score holding all of the other control variables constant. When reading the results the most important thing to look at is the sign and the significance level as indicated by the stars next to the estimate. If there are three stars then the estimate is highly statistically significant. The additional control variables included are as follows: the 1st year average mark (%) across all 1st year modules in order to capture the students overall performance, whether the students has studied Economics prior to enrolling at Aston, the students age, the students gender, whether the student is from home or overseas, the students socio-economic status (measured via parental occupation), the students ethnicity, the students school background and the programme the student is enrolled on.

To ease the burden on the reader, we are not reporting estimates for a number of our control variables (instead we simply record below that they were included). In addition, we only report results for 3 model specifications. In practice we have run a number of robustness tests – some of which will be discussed².

² These are all available on request.

Table 3: Results

Variables	(1) BS1102 Mark	(2) BS1102 Multiple Choice Test Mark	(3) BS1102 Essay Mark
1 st Year Mark	0.976*** (0.0396)	0.901*** (0.0856)	0.847*** (0.0684)
Watched Aston Replay	3.722*** (1.119)	1.681 (1.224)	3.109*** (1.356)
Economics	5.825*** (1.397)	6.184*** (1.291)	5.215*** (1.510)
Male	0.587 (1.013)	1.607 (1.136)	0.467 (1.375)
Overseas Student	-0.826 (2.034)	0.372 (1.411)	-3.168 (2.243)
Age (in years)	-0.493* (0.274)	0.0312 (0.302)	-0.598** (0.242)
Socio-economic Class Dummies	Yes	Yes	Yes
Ethnicity Dummies	Yes	Yes	Yes
School Dummies	Yes	Yes	Yes
Programme Dummies	Yes	Yes	Yes
Constant	6.968 (6.121)	13.24 (9.043)	10.62 (6.883)
Observations	382	340	338
R-squared	0.725	0.597	0.501

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

We will discuss our results (**Table 3**) by addressing each research question in turn:

Does watching Aston Replay improve student performance?

Model 1 above states that watching Aston Replay improves student performance on the module by 3.7% on average, holding all other control variables constant. In particular, this is controlling for the student's overall 1st year performance. The estimate is statistically significant. Indeed the 95% confidence interval (not reported) suggests that the estimate is between one and six percent. This is, therefore, quite an impressive result as it suggests that using Aston Replay may improve a student's module/degree performance by half a degree classification.

The coefficient estimate for the control variable that captures overall student performance (1st Year Mark) is positive and significant. This suggests that students who perform better across the year's additional modules also perform better in BS1102. In addition, the coefficient estimate for the variable Economics is highly significant. This suggests that studying Economics prior to enrolment at Aston improves a student's performance by 5.8%.

As robustness checks, we also ran two additional models (not reported here) which examined how the extent to which students used Aston Replay impacted on performance. First, we used the same specification as in (1) above, but now in addition including the number of minutes of Aston Replay watched across the period. Second, we included the total number of lectures watched on Aston Replay. The results suggest that neither of these variables has an impact on performance. One interpretation of this is that students were being selective in the material that they watched.

Does watching Aston Replay impact differently across modes of assessment?

Specifications (2) and (3) above run the model on the different components of assessment. Model (2) has the multiple choice test mark as the dependent variable, whilst model (3) has the essay mark as the dependent variable. The coefficient estimates are 1.681 and 3.109 respectively with only the latter being statistically significant. This suggests that watching Aston Replay only has an effect on the essay part of the exam compared to the multiple choice component. Very interestingly therefore, Aston Replay may only have an impact on assessment that captures deeper levels of understanding. This is a very interesting finding which needs further research, but if we use Klob's Learning Cycle (Klob, 1984) we can see that this finding confirms the fact that reflection on your learning is important and that Aston Replay is a tool to encourage reflection.

Does watching Aston Replay improve performance if it is only watched during the revision period?

To test this question we ran the same model as specification 1 with an additional control variable which equals one if a student watches Aston Replay only after the start of the revision period. The variable has a negative sign but is statistically insignificant. This contrasts to the variable "Watched Aston Replay" which remains positive and significant. This indicates that it doesn't matter when a student watches Aston Replay; it still impacts positively upon student performance.

Self-Selection

Overall, therefore, the above results suggest that Aston Replay has the potential to have a significant impact on a student's performance. Nevertheless, these results might be biased upwards. It might be the case that it is typically the more engaged and better performing students that are the ones who are using Aston Replay. Additional unreported results provide some evidence to suggest that this may be the case. If we estimate a model of the probability that a given student watches Aston Replay, this is significantly more likely for students with a high level of performance across all first-year modules. If this is the case it means that we may have a positive self-selection bias as these students may have performed better regardless of whether they made use of Aston Replay³. Consequently, our earlier results on the effect of watching Aston Replay should be interpreted with caution and are an upper bound on the size of this effect.

4. Related Literature and Implications for Professional Practice

There is now a growing literature which tries to assess the impact technology has on student learning of economics (see Agarwal and Day, 1998, as an example of one of the first papers). Two recent papers which are closely related to our research questions are Chen and Lin (2012) and Savage (2009). Similar to our results, Chen and Lin (2012) found, in an intermediate microeconomics course in Taiwan, that watching online recordings increased student exam performance by around 4%⁴. Furthermore, here most lecture views also occurred during the revision period. Interestingly, their results suggest that viewings immediately after the lecture did not have a positive impact on student performance. Perhaps this is due to reflection also. Finally, their data also shows that it was the students with poorer attendance records that made the most use of lecture recordings. In contrast, Savage (2009) did not find that students for which recordings were made available performed significantly better than a control group in which no recordings were available. In addition, student attendance did not differ between the two groups.

Two additional papers highlight potential issues with increased reliance on technology for lecture viewing. Flores and Savage (2007) point out that the recording of lectures may reduce interaction between the lecturer and the student and that student engagement may also be affected. Their survey results show that students who substitute online recordings for attending the live lecture valued the availability of recorded lectures highly. Furthermore, watching the lectures improved performance.

³ See Greene (2003, p.788) for a formal demonstration that this results in an upward bias.

⁴ Interestingly, Chen and Lin (2012) attempt to control for the possible self-selection bias described earlier by looking at the variation in a given student's lecture viewing and matching this with their performance on the relevant exam questions.

They also find, however, that a nontrivial subset of students do not use the technology in this way and, therefore, do not value its provision. This highlights that important trade-offs may be involved in increasing the use of technology in this way. Finally, Brown and Liedholm (2002) compare student performance when a course is taught live with the same course taught completely online. They find that student performance in the latter was inferior, especially on questions which aim to assess a deeper level of understanding. In addition, there was also some indication that the students taught online worked less hard on the course. This suggests therefore, that, whilst the availability of recorded lectures can be an extremely useful complement to live lectures, extreme caution should be exercised in any moves towards replacing these with recorded material.

5. Implications for Future Practice at Aston and Future Research

This research paper is the first of its kind for Aston students. Therefore, the implications of the results have to be interpreted with caution. At the beginning of each module, academics may wish to discuss student use of Aston Replay. For BS1102 the module leader explains to students how Aston Replay might be beneficial but emphasises the fact that Aston Replay is not a substitute for the reading list. Students are encouraged to attend lectures and only use Aston Replay to go back to parts of the lecture in which they have had the greatest difficulty. Anecdotal evidence suggests that students do this, yet more research is needed to determine whether this is actually the case. In addition, further research is needed to understand why a significant proportion of students do not use Aston Replay and also the impact that Aston Replay has on attendance. Finally, this research also needs to be extended to other modules across all of Aston's Schools to determine whether there is variation and if so explain why.

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Dr Chris Jones
Economics and Strategy Group
c.jones2@aston.ac.uk
Dr Matthew Olczak
m.olczak@aston.ac.uk
Economics and Strategy Group
Example used with Undergraduate Students
on module BS1102 Economic Environment of Business